Enclosure 3

Comments on Draft Safety Evaluation for WCAP-18461

(Non-Proprietary)

September 2020

SAFETY EVALUATION OF WCAP-18461-P/NP COMMON Q PLATFORM AND COMPONENT INTERFACE MODULE SYSTEM ELIMINATION OF TECHNICAL SPECIFICATION SURVEILLANCE REQUIREMENTS BY THE OFFICE OF NUCLEAR REACTOR REGULATION

1.0 INTRODUCTION

By letter dated March 9, 2020 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML20070R087), Westinghouse Electric Company (Westinghouse) submitted for the U.S. Nuclear Regulatory Commission (NRC) staff review WCAP-18461-P and WCAP-18461-NP, "Common Q Platform and Component Interface Module System Elimination of Technical Specification Surveillance Requirements" (Ref. 1). The stated purpose of this topical report (TR) is to eliminate technical specification (TS) surveillance requirements (SRs) related to the Common Q Platform and the Component Interface Module (CIM) and Safety Remote Node Controller (SRNC) System. The scope of WCAP-18461-P/NP is limited to TS SRs that would apply to an instrumentation and control (I&C) safety system using the Common Q Platform and the CIM/SRNC system. Westinghouse subsequently provided supplemental information related to WCAP-18461-P/NP to support the NRC’s safety evaluation (SE) (Ref. 8).

2.0 REGULATORY EVALUATION

The NRC staff considered the following regulatory requirements and guidance in reviewing the concepts presented in WCAP-18461-P/NP:

- Title 10 of the Code of Federal Regulations (10 CFR) 50.36, TS impose limits, operating conditions, and other requirements upon reactor facility operation for the public health and safety. Section 50.36(c)(3) states that “[s]urveillance requirements are requirements relating to test, calibration, or inspection to assure that the necessary quality of systems and components is maintained, that facility operation will be within safety limits, and that the limiting conditions for operation will be met.”

- 10 CFR Part 50, Appendix B, “Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants,” requires, in part, that licensees apply a quality assurance (QA) program to the design, fabrication, construction, and testing of structures, systems, and components of the facility.

The following are the NRC technical requirements applicable to WCAP-18461-P/NP:

- General Design Criteria (GDC) 21, “Protection System Reliability and Testability,” requires, in part, that the protection system be designed to permit its periodic testing during reactor operation, including a capability to test channels independently to determine failures and losses of redundancy that may have occurred.

- 10 CFR 50.55a(h), "Protection and Safety Systems" incorporates the 1991 version of IEEE Std. 603, "IEEE Standard Criteria for Safety Systems for Nuclear Power Generating Stations," by reference, including the correction sheet dated January 30, 1995.

- IEEE 603, Clause 5.7, "Capability for Test and Calibration" of IEEE Std 603-1991 states, in part, that the capability for testing and calibration of safety system equipment shall be provided during power operation and shall duplicate, as closely as practicable, performance of the safety function.

- IEEE 603, Clause 6.5, "Capability for Testing and Calibration," states, in part, that means shall be provided for checking, with a high degree of confidence, the operational availability of each sense and command feature input sensor required for a safety function during reactor operation.

- IEEE 603, Clause 4.10.2, in part, requires that the critical points in time after the onset of a design basis event are "defined for completion of the safety function."

The following are the specific NRC guidance documents applicable to WCAP-18461-P/NP:

- NUREG-0800, Standard Review Plan (SRP), Branch Technical Position (BTP) 7-17, "Guidance on Self-Test and Surveillance Test Provisions." WCAP-18461-P/NP addresses the acceptance criteria in BTP 7-17, which in part states that self-test functions should be verified during periodic functional tests.

- NUREG-1431, "Standard Technical Specifications, Westinghouse Plants."

- NUREG-1432, "Standard Technical Specifications, Combustion Engineering Plants."

3.0 TECHNICAL EVALUATION

The NRC staff reviewed the TR to verify that the Common ~~Qualification~~ Qualified (Common Q) platform self-diagnostics provide a level of confidence in channel operability that is equivalent to manual SRs typically required in TSs to demonstrate the operability of a channel in an I&C safety system (also referred to as channel operability tests). The NRC staff also evaluated the proposal for reasonable assurance that the operability of the system self-diagnostics is maintained and periodically verified, and that appropriate conditions for site specific use are identified in the TR. The NRC acceptance of this TR serves as a generic basis for site-specific license application requests (LARs) to remove channel operability test requirements.

Standard TS (STS) mark-ups were included in the TR to provide an example of how surveillance tests could be eliminated with supporting justification in the TR. These TS changes are however not proposed changes to the STSs and the NRC staff is not accepting the specific mark-ups as allowable TS for licensee's referencing this TR. Each licensee will need to perform a site-specific evaluation of both its licensing basis and site-specific TS, and can propose changes using, in part, the generic technical basis in the TR crediting self-diagnostics and considering the generalized TS examples in the TR to the extent applicable.

3.1. Overview of the Common Q Process Protection System Base Architecture

Common Q digital equipment and application software are used to implement functions for I&C safety systems. A base architecture is described in Section 2.1 of the TR. This base architecture provides a basis for equipment analyzed for SR elimination within the TR and within this SE. WCAP-18461 includes a licensee required action (LRA) in the TR that addresses site or application specific deviations from the base architecture. This is LRA 1.

The base architecture is a ~~process~~ plant protection system (PPS) that is similar to the protection and safety monitoring system (PMS) used for Vogtle Nuclear Power Plant, Units 3 and 4, to perform reactor trip (RT), engineered safety features actuation system (ESFAS), nuclear instrumentation (NI), diesel load sequencer (DLS), and post accident monitoring system (PAMS) functions. The PPS base architecture system is provided as Figure 2.1-1 of the TR. In addition, the TR base architecture includes provisions for a core protection calculator system to be used in Combustion Engineering plant designs.

The PPS base architecture is an integrated system which includes interfaces between the major functional components of the system. The PPS base architecture contains four divisions of process protection and two trains of RT and ESFAS logic and actuation. This base architecture establishes allocation of safety functions to components of the PPS as follows:

Function	***PPS Components to which Functions are Allocated***
Reactor Trip	Bistable Processing Logic Local Coincidence Logic
Engineered Safety Features Actuation System	Bistable Processing Logic Local Coincidence Logic Integrated Logic Processor Component Interface Module
Nuclear Instrumentation	Inputs provided to the Bistable Processing Logic Component
Post-Accident Monitoring System	Redundant PAMS Racks
Diesel Load Sequencer	Integrated Logic Processor Integrated into the Architecture
Core Protection Calculator	Described as an independent system with interfaces to the RTS in Appendix A of the Topical Report

3.2. Description of PPS Self-Diagnostic Functions

Sections 4 and 5 of WCAP-18461 describe self-diagnostic functions associated with a Common Q based PPS. There are three types of self-diagnostics that are used to detect faults in a Common Q PPS: 1) Common Q Platform Self-Diagnostics, 2) CIM/SRNC Self-Diagnostics, and 3) Application Self-Diagnostics.

3.2.1. PPS Common Q Platform Self-Diagnostic Functions

There are several self-diagnostic functions designed into the Common Q Platform. Any system design using Common Q Platform equipment will inherit these functions so even architectures that differ from the base architecture described in the TR will include these functions. These self-diagnostic functions are listed below and are described in the following sub-sections.

- ~~AC160 Self-Diagnostics~~
- Watchdog Timer Functions
- Memory Checking Functions
- High Speed Link Self-Diagnostics
- AF100 Bus Self Diagnostics
- Input / Output Module and Communications Interface Module Self-Diagnostics

3.2.1.1. AC160 Self-Diagnostics

The AC160 performs diagnostic and supervisory functions to continuously monitor the system for correct operation. Diagnostic functions monitor system operation and report any faults detected. Supervisory functions provide means of detecting and reporting system faults that affect the self-diagnostic capabilities of the system. Each type of AC160 module also has its own diagnostic functions. The AC160 monitors the system by collecting diagnostic information and checking the consistency of hardware configuration and application software.

Section 4 of WCAP-18461 describes three types of automatic self-test functions used to detect faults in the PPS. These self-diagnostic types are:

1. AC160 Platform Self-Diagnostics – These include AC160 module self-diagnostics, which are provided with the AC160 as part of the previously developed software and serve to verify the proper operation of the AC160 system. The collection and presenting of diagnostic information to the plant staff is determined at application design time. AC160 Platform Self-diagnostic functions are implemented by the Common Q equipment manufacturer.

2. CIM/SRNC Self-Diagnostics – CIM/SRNC self-diagnostics are implemented in hardware and firmware design by Westinghouse.

3. Common Q Application Self-diagnostics - Application automatic self-testing that tests the proper functioning of the Common Q plant specific applications. Application self-diagnostics are developed in conjunction with plant specific safety application software.

Common Q self-diagnostic functions described in this section (3.2.1.1) are designed to run continuously as background operations. There are also automatic self-tests that run only when starting the system. Further details of AC160 self-diagnostics are provided in Section 4.1.1.3 of the Common Q TR (Ref. 2).

3.2.1.2. Watchdog Timer Functions

A Common Q processor module is composed of two internal sections, a processing section and a communications section. Each of these sections contains a microprocessor and both microprocessors have an associated Window Watchdog Timer (WWDT). Each WWDT is a precision timing device that must be triggered within a defined window of time. If the WWDT is triggered earlier or later than this time window, then the timer output changes state. When a change of state occurs on either of the WWDTs, the Watchdog Timer (WDT)WWDT relay whose contacts are accessible from the processor front panel changes state.

Depending on the specific system application, the WDT WWDT relay can be used to annunciate a failure, actuate a divisional trip, or set output states to predefined conditions. Appendix A of tThe Common Q TR, WCAP-16097, Revision 5 (ADAMS Package Accession No. ML20171A339) provides additional information on the WDT configuration. Additional WDTs are associated with the processing section of the Common Q processor module (PM646A) known as stall timers. [

]a,c

3.2.1.3. Memory Check Functions

Memory check functions are performed both during system startup and continuously during operation as follows:

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]a,c

The system also performs a Random-Access Memory (RAM) test. **[[**

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Once the system is running, the following memory check functions are continuously performed.

a) Domain CRC check - The CRC checksums of all read-only domains in RAM are verified.

b) Test of system and user FPROM. This test checks the CRC checksum of:
- The system software in the system FPROM
- The application in the user FPROM

[

]a,c

3.2.1.4. High Speed Link Self-Diagnostics

High Speed Link (HSL) diagnostics are executed to detect physical layer failures and failures of the communication link to another PM646A processor module. The physical layer of the high level data link control (HDLC) protocol is secured through a CRC. **[[**

]] All detected errors are reported to the application program. An application program is a plant specific program that is developed to perform the safety functions of the system.

3.2.1.5. AF100 Bus Self-Diagnostics

The AF100 uses bus mastership to continuously monitor the status of the nodes on the bus. The AF100 communication interface, CI631, monitors the validity of received data sets. If no data has been received for four cycles or if the communication interface has failed, the database element for the data set will be flagged as failed. The control module programming monitors the database element flag and performs error processing.

3.2.1.6. Input / Output Module and Communications Interface Module Self-Diagnostics

Diagnostics of the input / output (I/O) and communication interface modules are executed by interrogating all modules for errors. The I/O modules diagnostics are reported to the processor module base software diagnostics routine via a device status word.

3.2.2. Component Interface Module and SRNC Self-Diagnostics

The Westinghouse designed CIM system, consisting of the CIM, SRNC, and double and single width transition panel (DWTP/SWTP), is used to provide device control interface for direct current (DC)-powered components. A modified version of the current CIM design with different solid-state relays capable of handling the alternating current (AC) loads will need to be used if actuation of AC powered components is required. This modified version of the existing CIM design is still under development, which is covered by application specific action items (ASAI) 1. The SRNC provides a data link or bridge between the AC160 controller and the CIM. The DWTP and SWTP components, which are located between the SRNC and CIM, are used to pass communication signals among the SRNC, CIM, and the non-safety-related plant control system through the remote node controller (RNC).

The field programmable gate array (FPGA)-based CIM subsystem uses a series of self-diagnostic functions to detect faults within the CIM subsystem of the PPS. [ ]a,c Detailed descriptions for each of these CIM self-diagnostic functions is provided in Sections 5.2.1 and 5.2.2 of WCAP-18461. The CIM is also designed to receive commands from non-safety-related systems, therefore, self-diagnostic of the non-safety signal path is provided to detect failures of non-safety related logic. [ ]a,c

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The above CIM/SRNC self-diagnostic functions are designed to detect communication problems, internal faults, and power supply issues, [ ]a,c and therefore can be credited for establishing and assuring operability of the CIM/SRNC subsystem of the PPS.

3.2.3. PPS Application-Specific Self-Diagnostics

The base PPS architecture is designed with application-specific, self-diagnostic functions as described in Section 5.3 of WCAP-18461. Application-specific alarms and annunciation functions are designed to periodically transmit the self-diagnostic information for the PPS components and application software to [

][a,c]

Although application self-diagnostics are plant specific and no specific application was provided to the NRC to support this evaluation, the TR includes descriptions of the following application-specific, self-diagnostic functions that are expected to be implemented in the base PPS architecture design.

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][a,c]

Other application-specific self-diagnostic functions cannot be generically evaluated or approved as a basis for SR elimination. Therefore, a licensee referencing this TR should identify application-specific self-diagnostic functions to be credited for SR elimination and perform an analysis to determine if these diagnostic functions satisfy applicable operability verification criteria. This analysis is required to be performed for all plant specific self-diagnostic functions to be credited for eliminating SRs that are not described in WCAP-18461, See ASAI-3.

3.3. Evaluation of Standard TS Surveillance Requirements

STS, Sections 3.1 and 3.3 of NUREG 1431, provide SRs and limiting conditions for operation (LCO) for the safety functions performed by the base architecture PPS as described in the TR.

The expected PPS configuration is to maintain operability of all processor redundancies in each division. This means ensuring that applicable SRs will continue to be met in each PPS division. Consistent with this expectation, the PPS self-diagnostic functions automatically and continuously monitor the proper operation of the PPS digital components, including each redundant subsystem, and provide assurance of PPS operability. The SRs currently specified in NUREG-1431, Section 1.1, implement the following defined tests for the listed subsystems, for which the TR proposes crediting PPS self-diagnostics for assuring system and subsystem operability:

- CHANNEL CHECK - A CHANNEL CHECK shall be the qualitative assessment by observation, of channel behavior during operation. This determination shall include, where possible, comparison of the channel indication and status to other indications or status derived from independent instrument channels measuring the same parameter.

- CHANNEL OPERATIONAL TEST (COT) - A COT shall be the injection of a simulated or actual signal TEST (COT) into the channel as close to the sensor as practicable to verify OPERABILITY of all devices in the channel required for channel OPERABILITY. The COT shall include adjustments, as necessary, of the required alarm, interlock, and trip setpoints required for channel OPERABILITY such that the setpoints are within the necessary range and accuracy. The COT may be performed by means of any series of sequential, overlapping, or total channel steps.

- CHANNEL CALIBRATION - A CHANNEL CALIBRATION shall be the adjustment, as necessary, of the channel output such that it responds within the necessary range and accuracy to known values of the parameter that the channel monitors. The CHANNEL CALIBRATION shall encompass all devices in the channel required for channel OPERABILITY. Calibration of instrument channels with resistance temperature detector (RTD) or thermocouple sensors may consist of an in place qualitative assessment of sensor behavior and normal calibration of the remaining adjustable devices in the channel. The CHANNEL CALIBRATION may be performed by means of any series of sequential, overlapping, or total channel steps.

  Note: WCAP-18461-P/NP provides a revision to the definition of CHANNEL CALIBRATION. Instead of stating: "The CHANNEL CALIBRATION shall encompass all devices in the channel required for channel OPERABILITY." The revised definition states the following: "The CHANNEL CALIBRATION shall encompass all devices in the instrument channel from the sensor to the analog-to-digital converter."

- ACTUATION LOGIC TEST (ALT) - An ALT shall be the application of various simulated or actual input combinations in conjunction with each possible interlock logic state required for OPERABILITY of a logic circuit and the verification of the required logic output. The ALT, as a minimum, shall include a continuity check of output devices.

I&C safety system LCO operability requirements are unchanged by implementation of this TR. However, the TR presents a case for removing certain I&C safety system SRs currently specified to assure the LCOs are met. The basis for elimination of these SRs is that self-diagnostic functions can provide equal or greater assurance that LCOs are met.

Section 3.3.2 of this SE describes and evaluates changes to the STS surveillance test requirements to verify that system operability can be reasonably maintained during PPS system operation when the WCAP-18461 surveillance elimination methods are applied.

3.3.1. Use of PPS Base Architecture Self-Diagnostic Functions to Verify Operability

The primary objective of periodically conducting SRs on PPS components is to assure their operability. The NRC staff's evaluation of the proposed elimination of SR requirements involves verifying that: 1) the PPS self-diagnostic functions being credited can adequately demonstrate operability of all components covered by the SRs; 2) the PPS self-diagnostic functions execute deterministically and all detected faults actuate system alarms; and 3) quality of the built-in PPS self-diagnostic functions is sufficient to support compliance with 10 CFR Part 50, Appendix B QA requirements. Acceptability of the proposed methodology for using allocated response times for the PPS system to meet the SRs for the overall response time tests (RTTs) is also evaluated below.

All PPS Common-Q modules contain built-in self-diagnostic functions. These self-diagnostic functions, as described in Section 3.2 of this SE, continuously monitor logic operability and alert the operator of Common Q equipment failure. The PPS Common- Q processor modules monitor the system by collecting diagnostic information from other Common Q modules and checking the consistency of the hardware configuration with the application software installed. The functions of the Common Q processors are monitored by system self-diagnostics both during system power-up and normal operations.

Section 7 of WCAP-18461 describes a method for determining if TS SRs can be eliminated. This method involves: 1) identifying system components that are tested by the manual SR tests, 2) Identifying failure modes for those components, 3) mapping diagnostic functions to the failure modes identified, and 4) evaluating if system self-diagnostic functions provide an adequate means of identifying and responding to postulated component failures. This method provides a means of establishing failure mode coverage by self-diagnostics that is equal or greater than the failure mode coverage provided by performing manual surveillance testing.

While the FMEDA analysis is used to support elimination of TS SRs, the method described in Section 7 of WCAP-18461 identifies which Common Q (or CIM system) components are included in the scope of specific SRs. Therefore, if FMEDA tables determine that system components do not have full diagnostic coverage, then a WCAP-18461 based analyses will determine if SRs that include these components within their scope will need to be retained. WCAP-18461 includes LRA 2 which states: *"The licensee will have to compare the plant-specific application [failure modes and effects analysis] FMEA with the failure modes identified in the FMEDA tables within this analysis. This should be done to conclude that the FMEA herein is bounded by the plant-specific application FMEA."* Therefore, a licensee referencing WCAP-18461 will need to perform a plant specific FMEA to support its analysis of test coverage by system self-diagnostics.

The following subsections describe the NRC staff evaluations of each of the SRs proposed to be eliminated in the TS mark-ups provided in Appendix D of WCAP-18461. The NRC staff is not approving the specific TS mark-ups for incorporation by licensee. Instead, the NRC reviewed the Westinghouse application of the method described above to establish a basis for approval of these methods for the typical TS associated with ensuring PPS system and subsystem operability. These evaluation conclusions support the NRC staff's acceptance of WCAP-18461 methods for reference as a basis for eliminating plant SRs from plant TSs.

3.3.1.1. <u>Evaluation of Removing Channel Check SR for PPS Components</u>

The TS mark-up in WCAP-18461 eliminates channel check surveillance tests for PPS by crediting PPS self-diagnostics that are designed to perform automatic continuous channel check functions. The current channel check surveillance tests for the PPS defined in the STS require manually comparing PPS instrumentation function channels in the four PPS divisions (inter-channel check) to determine if there is a significant deviation that may indicate an instrument failure. Channel checks performed for Combustion Engineering plants have a similar definition and the same principles for evaluating elimination of channel check SRs apply.

The PPS application-level self-diagnostic functions, which are credited to perform the channel check function, include [

][a,c]

The NRC staff determined that the PPS application-specific [ ][a,c] as described in Section 3.2.3 of this SE and in Sections 2.1.9 and 5.3.1 of WCAP-18461, verifies the same information as the manual channel checks performed in accordance with the current STS SRs. The NRC staff finds that the [ ][a,c] is an acceptable alternative to the manual channel check. Therefore, in cases where [ ][a,c] requirements for performing periodic manual channel check surveillance tests can be eliminated.

3.3.1.2. Evaluation of Removing Manual Channel Operational Test or Channel Functional Test SRs for ~~PMS~~ PPS Components

The mark-up of WCAP-18461 eliminates COTs for PPS by crediting PPS self-diagnostics that are designed to continuously verify operability of PPS components. The COTs include verification of the required alarm, interlock, and trip setpoints, such that the setpoints are within the required tolerance.

Verification of operability is accomplished by detecting and annunciating faults that have potential of affecting system safety functions. FMEDA tables provided in Section 6 of WCAP-18461 identify self-diagnostic fault detection functions that can detect and provide annunciation for postulated failure modes of the PPS.

For many of the postulated failures, [

][a,c] The NRC staff notes, these diverse features of the Common Q diagnostic functions are not generally credited as part of a plant design or licensing basis.

These FMEDA tables are intended to show failure mode coverage by the system self-diagnostics functions to justify elimination of the COT SRs. However, the FMEDA tables in WCAP-18461 are not plant specific so they do not necessarily reflect all credible failure modes that would otherwise be addressed by a plant's COT SRs. Additionally, application specific self-diagnostic functions may not be reflected in these tables. To address these application specific aspects of the FMEDA tables, Westinghouse has included LRA 2 in Appendix B of WCAP-18461. This LRA states the following:

> *The licensee will have to compare the plant-specific application FMEA with the failure modes identified in the FMEDA tables within this analysis. This should be done to conclude that the FMEA herein is bounded by the plant-specific application FMEA.*

The NRC staff determined this LRA requires additional clarification of the specific reviews and analysis need to provide reasonable assurance that the FMEA is bounded. When performing a comparison of application FMEA with the FMEDA tables in WCAP-18461, the following actions should be performed:

1. Identify any failure modes that are plant specific, (i.e., not identified in the WCAP-18461 FMEDA tables) and perform an analysis of system self-diagnostic features to determine if each failure mode is detectable by an existing function or if a new plant application diagnostic function is required.

2. Review all application self-diagnostic functions identified in the FMEA and FMEDA tables and verify that each function is either included in the system design or is identified as a system application requirement to be developed and implemented in the system design.

3. Identify any components or subsystems in the WCAP-18461 FMEDA tables that are not being implemented in the plant design or are being implemented in the plant specific design in a manner different than described in Section 2.1, "Base Architecture," of the WCAP-18461.

4. Each of the functions performed by these components or sub-systems should then be analyzed to determine the effects of any reduced diagnostic coverage.

The NRC staff determined the use of FMEDA tables in WCAP-18461 provides an acceptable basis for COT surveillance elimination with the understanding that LRA 2 will be performed by a licensee referencing this TR in the manner described in ASAI 4.

Application-level self-diagnostic functions, which are proposed to be credited to demonstrate channel operability include **[[**

]] A fault detected by the PPS diagnostic functions is designed to generate visual and audible annunciation in the MCR to alert the operator of detected PPS faults.

The NRC staff determined there are multiple platform and application-level self-diagnostic functions that are designed to detect faults associated with PPS failure modes identified in the FMEDA tables provided in WCAP-18461. To eliminate manual COT surveillance requirements, the PPS self-diagnostic functions, should be demonstrated to be capable of detecting all faults that would be detected during performance of manual COT. The NRC staff finds that the verification of operability of PPS components can be reasonably achieved with a combination of the PPS Common- Q based platform level and the PPS application-level self-diagnostic functions. Because not all application level self-diagnostics are evaluated as part of this SE, a plant specific action to evaluate application-level self-diagnostic functions that are to be credited for accomplishment of operability verification must be performed to support elimination of manual COT tests. This is ASAI 4.

3.3.1.3. Evaluation of Removing Manual ALT SR for ~~PMS~~ PPS Components

The mark-up of the Westinghouse STS in WCAP-18461 credits PPS self-diagnostic functions that test system logic capability and accordingly removes requirements to perform manual ALT SRs for the PPS. Existing plant ALT surveillance tests include the application of various simulated or actual input combinations in conjunction with each possible interlock logic state required for operability of a logic circuit and the verification of the required logic output.

For the Common- Q PPS, components that are tested by performance of ALT SRs are the same PPS components as those credited for removal of COT SRs as described in Section 3.3.1.2 of this SE. The evaluation above shows that the self-diagnostic test functions of those PPS components could be credited and used to adequately verify the operability of the same PPS components, which would be manually tested under ALT SRs. In addition, the internal faults detected by the PPS self-diagnostic functions are designed to produce visual and audible annunciation in the MCR, so that the operators can take the appropriate actions according to plant operating procedures.

The scope of the PPS RTS components for the ALT also includes Common Q components for which the FMEDA does not identify diagnostic coverage. The ALT SRs for these PPS components are not fully covered by the PPS self-diagnostic functions. SRs for these PPS components should be retained.

For most PPS components that are tested by ALT SRs, the PPS self-diagnostic functions provide an adequate means of detecting faults that could otherwise be detected during performance of manual ALT. For PPS components in which diagnostic coverage is not provided, the associated SRs must either be retained, or new SRs should be created to ensure safety function operability.

The NRC staff finds that self-diagnostic functions credited for PPS components can be used as a basis for elimination of ALT SRs if diagnostic coverage of the ~~PMS~~ PPS components which would be tested under the existing ALT SRs can be demonstrated by the FMEDA and application FMEA results. The NRC staff also finds that verification of operability for PPS components can be reasonably achieved with a combination of the PPS Common~~-~~ Q based self-diagnostic functions and SRs.

3.3.1.4. Evaluation of Removing Manual Actuation Logic Output Test SRs for PPS Components

WCAP-18461 does not propose elimination of actuation logic output test (ALOT) SRs. Instead, it states the following:

> *The actuation logic output test (ALOT) is not listed in NUREG-1431 (Reference 2) since these TS were based upon analog technology. However, if a safety system were to upgrade to Common Q (as depicted by the PPS within this topical report), there would need to be a surveillance test to cover the Common Q equipment from the ILP to the CIM outputs.*

The NRC staff therefore did not evaluate elimination of ALOT SRs for the Base PPS system. Although an ALOT SR is not included in the standard Westinghouse TS (NUREG-1431), it is addressed within the TR to establish the scope of TS surveillances to be analyzed. The licensee installing the PPS system should therefore evaluate the need to add ALOT SRs based on the plant specific design characteristics and the ability of PPS self-diagnostics to identify failure modes of PPS logic output components. The process for determining the need for ALOT SRs is like the processes used for COT and ALT SR elimination described in WCAP-18461, Appendix D.

3.3.1.5. Evaluation of Removing Time Response SR for PPS Components

Section 7.3.1 of WCAP-18461 provides a method for determining assumed time intervals for the digital time response (allocated response times) of PPS equipment to process sensor input signals using digital logic and generate an actuation signal to an actuated device. These allocated time intervals can be used to conservatively bound the time intervals measured during manual testing of PPS equipment. A licensee implementing these methods can use these allocated response times instead of measured response times as part of determining the RTS and ESF overall response times. The overall response times include measured response time of the instrument sensor channel to provide an input signal to the PPS digital logic and the measured response time for the actuated device to reposition to its safety position (e.g., the closing of a valve, the opening of a breaker), as well as the PPS digital time response.

The NRC staff reviewed the analysis methodology in Section 7.3 of WCAP-18461 to determine if it acceptably justifies the proposed use of allocated time intervals for PPS digital components. The overall RTT SRs for verifying the reactor trip and ESFAS actuation response times include response times of sensors, PPS instrumentation, and the actuating devices. The objective of these ~~TRs~~ SRs is to verify that reactor trip and ESFAS protective functions can be accomplished within the times allocated in a plants' accident analysis.

The current definitions for the RTT in both NUREG-1431 and NUREG-1432 state: "In lieu of measurement, response time may be verified for selected components provided that the components and methodology for verification have been previously reviewed and approved by the NRC." The NRC staff previously approved a similar methodology for elimination of periodic protection channel RTTs for WEC 7100, 7300, Eagle 21, and solid-state protection system platforms.

The methodology in WCAP-18461 modifies the approach for satisfying the PPS RTT SRs by applying allocated response times for the PPS instrumentation, in lieu of performing manual tests to support the overall RTTs required by the TS SRs. The methodology only applies to PPS instrumentation components and does not change RTT requirements for sensors or actuating devices. Allocated response times for the PPS for each of the RT and ESFAS protective functions are to be obtained from PPS functional requirements.

Once established, the response time for components of the PPS normally do not change unless a credible failure occurs that impacts its response time. The WCAP-18461 methodology shows how the RTTs for the PPS components Reactor trip and ESFAS safety functional signal paths could be replaced with allocated response times.

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The NRC staff finds the methodology presented in WCAP-18461 Section 7.3.1 for elimination of RTT SRs acceptable because it satisfies the applicable requirements of 10 CFR 50.55a(h) as articulated in Clause 4.10 IEEE Std. 603-1991. PPS component allocated response times can therefore be used to support overall RTT SRs.

3.3.1.6. Safety Conclusion for SR elimination

The NRC staff determined that Common Q self-diagnostic functions can provide an adequate means of providing continuous confirmation of PPS system operability. Common Q self-diagnostics functions can therefore be credited as an acceptable alternative to performing periodic manual surveillance tests to ensure PPS system operability during plant operation. To eliminate manual surveillance test requirements, an analysis of system failure modes must be performed to confirm that system specific self-diagnostics failure detection capabilities provide coverage for all failure modes that would otherwise be detected by the manual surveillance tests to be eliminated.

Because no specific application was provided to support this TR evaluation, the NRC staff is unable to make safety conclusions for functions that rely on application specific diagnostic functions. Therefore, a licensee referencing this topical report must perform an evaluation of application self-diagnostic functions to be credited for elimination of SRs to determine if these functions provide adequate assurance of PPS component operability to support SR elimination. This is ASAI 3.

3.3.2. PPS Base Architecture Self-Diagnostic Supervisory Functions

The Common-Q platform includes means of detecting and reporting system faults that affect the self-diagnostic capabilities of the system. These means are hereby referred to as self-diagnostic supervisory functions. WCAP-18461 describes two types of self-diagnostic supervisory functions: 1) automatic functions that monitor performance of self-diagnostic features, and 2) administrative actions taken by the licensee to assure that self-diagnostic functions are operating.

3.3.2.1. Automatic Self-Diagnostic Supervisory Functions

There are confirmatory mechanisms in the Common-Q platform designed to verify that self-diagnostic functions operate as designed. WCAP-18461 states that functionality of some Common-Q hardware-based internal self-diagnostic functions is confirmed by [

]a,c

Configuration and operability of the Common-Q self-diagnostic functions are [

]a,c

The Common-Q processors also perform memory checking functions to confirm the integrity of the system software, application software, and data stored in memory. A description of these memory checking functions is provided in Section 3.2 of this SE and additional details of these functions are provided in the Common Q Platform TR (Ref. 2).

A failure of a self-diagnostic function actuates a division fault alarm. Section 4.4 of WCAP-18461 describes a division fault alarm that is the primary indication that there is a fault within the PPS. An evaluation of a division fault alarm condition should be performed by plant operations and maintenance staff upon actuation. In the absence of a division fault alarm, the licensee will also perform activities including operator rounds and system health reviews that evaluate and document the health, errors, and faults of system.

3.3.2.2. <u>Administrative Action Supervisory Functions</u>

WCAP-18461 includes a licensee required action (LRA 8) that requires licensees to *"… provide a description of plant administrative controls that will provide assurance (defense-in-depth) that faults are captured and investigated. This may include items such as operator rounds and system engineer monthly reports that evaluate and document the health, errors, and faults of the safety system."*

These additional administrative controls are implemented to ensure the continued adequate functionality of the PPS system diagnostic functions during operations. Each of the four PPS divisions performs independent self-diagnostic functions and the PPS is designed such that execution of safety functions has higher priority than the self-diagnostic functions. In addition, even if one PPS division fails because of a self-diagnostic failure, the other three PPS divisions are designed to be available to perform the systems safety functions. Therefore, the NRC staff determined there is reasonable assurance that failure of a credited PPS self-diagnostic function will not prevent the PPS from performing its safety functions. The NRC staff agrees that automatic self-diagnostic supervisory functions as complemented by administrative actions invoked by LRA 8 provide confidence that automatic self-diagnostic functions are continuously monitoring system operability. The NRC staff has also determined that the administrative actions invoked by LRA 8 are needed to complement automatic supervisory functions to address potential supervisory function failures which may be otherwise undetectable.

In addition to actuation of the division fault alarm, detected faults and system errors are logged in the PPS processor memory and can be retrieved and evaluated according to the plant operating procedures. Such records and their evaluations can also be used to identify and assess functionality of the self-diagnostics, detect adverse trends in the condition of the PPS and alert plant staff to take corrective actions when needed. The NRC staff determined that the PPS self-diagnostic functions can be used to continuously monitor operability of the ~~PMS~~ PPS components covered by the referenced manual PPS-related SRs and alert the operator of detected failures.

3.3.3. <u>Deterministic Performance</u>

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Based on the above evaluation of the self-diagnostics testing performance, and the Common Q CPU loads being limited **[[** **]]**, the NRC staff determined the Common- Q self-diagnostic functions execute deterministically and generate appropriate system responses to conditions resulting from a self-diagnostic function failing to execute or complete satisfactorily.

3.3.4. Review of Westinghouse Standard Technical Specification Changes

Appendix D of WCAP-18461 includes a mark-up of NUREG-1431, the Westinghouse STS. This appendix provides a framework for how to make TS changes using analysis techniques of WCAP-18461. They are an example of how surveillance tests could be eliminated with supporting justification. These TS changes are however not proposed changes to the STSs and the NRC staff did not review the specific mark-ups as allowable TS for licensee's referencing this TR. Below is a summary of these mark-ups.

NOTE: All numeric references to specific TSs and TS tables are to the NUREG-1431 STS.

- SRs requiring a manual Channel Check to be performed on Common Q components are removed from the STS. This involves removing SRs 3.3.1.1, 3.3.2.1, 3.3.5.1, 3.3.6.1, 3.3.7.1, 3.3.8.1, 3.3.9.1, 3.4.15.1, and 3.9.3.1. Tables 3.3.1-1, 3.3.2-1, 3.3.6-1, 3.3.7-1, and 3.3.8-1 are revised to reflect removal of these channel check SRs.

- SRs requiring a manual Channel Operability Tests (COT) to be performed on Common Q components are removed from the STS. This involves removing SRs 3.1.8.1, 3.3.1.7, 3.3.1.8, 3.3.1.13, 3.3.2.5, 3.3.6.6, 3.3.7.2, 3.3.8.2, 3.3.9.2, 3.4.15.2, and 3.4.19.2. Tables 3.3.1-1, 3.3.2-1, 3.3.6-1, 3.3.7-1, and 3.3.8-1 are also being revised to reflect removal of these COT SRs. In addition, TS Subsection 5.5.19, Setpoint Program (SP), was modified to delete the reference to the COT.

- SRs requiring a manual Actuation Logic Test (ALT) to be performed on Common Q components are removed from the STS. This involves removing SRs 3.3.1.5, 3.3.2.2, 3.3.2.3, 3.3.6.2, 3.3.6.4, 3.3.7.3, 3.3.7.5, 3.3.8.3, and 3.4.19.3. Tables 3.3.1-1, 3.3.2-1, 3.3.6-1, 3.3.7-1, and 3.3.8-1 are also being revised to reflect removal of these ALT SRs.

- SRs requiring a manual MASTER RELAY TEST to be performed on PPS components are removed from the STS. This involves removing SRs 3.3.2.4, 3.3.6.3, 3.3.6.5, 3.3.7.4, and 3.3.7.6. Tables 3.3.2-1, 3.3.6-1, and 3.3.7-1 are also being revised to reflect removal of these MASTER RELAY TEST SRs.

- SRs requiring a manual SLAVE RELAY TEST to be performed on PPS components are removed from the STS. This involves removing SRs 3.3.2.6, 3.3.6.7, and 3.3.7.7. Tables 3.3.2-1, 3.3.6-1, and 3.3.7-1 are also being revised to reflect removal of these SLAVE RELAY TEST SRs.

The NRC staff examined the general process and example TS markups and agree that they highlight the potential use of the TR to justify the example changes. Each licensee will need to perform a site-specific evaluation of both its licensing basis and site-specific TS to demonstrate compliance with 10 CFR 50.36. The licensee can use, in part, the generic technical basis in the TR crediting self-diagnostics and considering the generalized TS examples in the TR to the extent applicable.

3.3.5. <u>Review of Combustion Engineering Standard Technical Specification Changes</u>

No mark-up of NUREG-1432, Combustion Engineering STS was provided in WCAP-18461-P/NP. However, the process for making required changes to plant specific TSs is provided in Appendix D.

3.4. <u>Evaluation of PPS Self-Diagnostic Quality</u>

The AC160 diagnostic functions are developed and commercially dedicated to the same quality standards as the rest of the AC160 system software. The software design and lifecycle processes applied to Common Q system software are also used for the Common- Q diagnostic functions. These processes were previously accepted by the NRC as part of the Common Q Platform TR evaluation (Ref. 2).

WCAP-18461 states that "Westinghouse has subjected this equipment to equipment qualification testing and uses the same quality processes to commercially dedicate, assemble, and test this equipment as the other PPS safety equipment at a given plant, since most of the platform self-diagnostics are integral to the equipment that performs the safety functions.

During the Common Q Platform TR evaluation, the NRC staff reviewed the commercial dedication activities performed by WEC to qualify the Common- Q platform components and concluded that criteria set forth in BTP 7-14 and the guidance in EPRI TR-106439 were followed. Section 4.2 of the Common Q Platform TR safety evaluation, "Evaluation of the Commercial-Grade Dedication of the Common Q Platform," provides an evaluation of the CGD processes used by Westinghouse to certify Common Q Platform components and software for use in nuclear power plant safety related applications and determined that these processes were acceptable.

During the NRC evaluation of the Vogtle LAR 19-01 (Ref. 9), the NRC staff reviewed platform modification processes and controls, and evaluated operational history of Common- Q based systems that might impact the functionality of the Common- Q Platform. This evaluation supplemented the previous NRC staff platform evaluation, which included an evaluation of the CGD processes employed by Westinghouse, to confirm that the Common Q diagnostic functions were suitably developed and tested and will be adequately maintained during the operational phase of the development lifecycle.

The CIM system requirements including those related to their self-diagnostic functions have been tested and verified by Westinghouse. The quality of the same CIM system design and development process were assessed and inspected by the NRC staff for the AP1000 standard design certification. For the Vogtle AP1000, Units 3 and 4, the same CIM system went through NRC ITAAC (Inspections, Tests, Analyses, and Acceptance Criteria) inspections for its design and development process and was found acceptable for the AP1000 PMS. In addition, during the NRC evaluation of the Vogtle LAR 19-01 (Ref. 9), the NRC staff reviewed the QA of the self-diagnostic functions for the same CIM system and found that its self-diagnostic functions credited were adequately developed, tested, and verified using rigorous processes in accordance with Appendix B requirements.

On the basis of the NRC staff SE report's for the Common Q Platform and Software Program Manual (Refs. 2 and 3) and the supplemental review activities of the self-diagnostic aspects for Vogtle LAR 19-01, the NRC staff finds that that Common- Q and CIM/SRNC diagnostic functions to be credited in Section 3.3 of this SE were developed, tested, qualified, and will be maintained using rigorous processes in accordance with 10 CFR Part 50, Appendix B requirements.

Though a licensee referencing WCAP-18461 may delegate work for establishing and executing the QA program for Common Q equipment to Westinghouse, the licensee remains responsible for the establishment and execution of the QA program in accordance with 10 CFR Part 50, Appendix B.

3.5. Regulatory Compliance

The methodology provided in WCAP-18461-P/NP credits system self-diagnostic functions as an alternate means of providing adequate assurance that the necessary quality of systems and components is maintained, that facility operation will be within safety limits, and that the limiting conditions for operation will be met. The NRC staff finds this methodology can be applied to eliminate surveillance requirements for components in which self-diagnostic coverage can be demonstrated. A licensee applying these methods shall perform a plant specific assessment of system diagnostics to ensure that requirements of 10 CFR 36(c) can be met upon elimination of SRs.

WCAP-18461-P/NP addresses the acceptance criteria in BTP 7-17, which in part states that self-test functions should be verified during periodic functional tests. The LAR addresses these criteria as follows:

- For a Common~~-~~ Q based ~~PMS~~ PPS subsystem, [

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- WCAP-18461 includes an action (LRA 8) that requires licensees to "…provide a description of plant administrative controls that will provide assurance (defense-in-depth) that faults are captured and investigated. This may include items such as operator rounds, and system engineer monthly reports that evaluate and document the health, errors, and faults of the safety system."

Therefore, based on the above evaluations of both Common- Q based and FPGA-based CIM/SRNC subsystems, the NRC staff determined that the approaches described in WCAP-18461 meet the criteria in BTP 7-17 for checking and monitoring the PPS self-diagnostic functions during operation.

The NRC staff finds the WCAP-18461 methodologies for elimination of SRs to be consistent with regulatory requirements of GDC 21 and 10 CFR 50.55a(h) applicable to reliability and testability of the PPS base architecture. The NRC staff also determined that PPS automatic self-diagnostic functions continuously monitor safety function logic operability and are designed to alert the operator of failures. The combined PPS system and application-level automatic self-diagnostic functions can be credited to provide adequate testing coverage comparable to manual PPS surveillance testing. Therefore, the NRC staff finds that the PPS automatic self-diagnostics functions can be used to verify the safety systems' capability to perform its safety functions. These self-diagnostic functions may therefore be credited in lieu of certain manual SR testing provided there is an acceptable risk profile for the design of a plant to which this TR will be applied and all LRAs in WCAP-18461 and ASAIs in Section 4.0 of this SE are performed.

4.0 APPLICATION SPECIFIC ACTION ITEMS

ASAI 1 - The current CIM output solid-state relays are designed to only interface with DC components. If the CIM system is required to interface with AC powered components for a specific application, then a modified version of the current CIM design with different solid-state relays capable of handling the AC loads, which is still under development, needs to be used. A licensee referencing this topical report should perform additional assessment of the modified CIM design to make sure that the findings related to the CIM self-diagnostic functions in this SE are still applicable.

ASAI 2 - For specific application cases which use CIMs in series, for interfacing with components with power lock-out requirements, or with intentionally disabled output tests, a licensee referencing this topical report should ensure that the surveillance detect relevant failures which are not covered by the CIM output test self-diagnostic functions.

ASAI 3 - A licensee referencing this topical report should perform an assessment of all plant specific self-diagnostic functions to be credited for SR elimination to determine if they satisfy applicable operability verification criteria.

ASAI 4 - When performing a comparison of application FMEA with the FMEDA tables in WCAP-18461, the following actions should be performed:

1. Identify any failure modes that are plant specific (i.e., not identified in the WCAP-18461 FMEDA tables) and perform an analysis of system self-diagnostic features to determine if each failure mode is detectable by an existing function or if a new plant application diagnostic function is required.

2. Review all application self-diagnostic functions identified in the FMEA and FMEDA tables and verify that each function is either included in the system design or is identified as a system application requirement to be developed and implemented in the system design.

3. Identify any components or subsystems in the WCAP-18461 FMEDA tables that are not being implemented in the plant design or are being implemented in the plant specific design in a manner different than described in Section 2.1, “Base Architecture,” of the WCAP-18461.

4. Each of the functions performed by these components or sub-systems should then be analyzed to determine the effects of any reduced diagnostic coverage.

6.0 CONCLUSION

The NRC staff determined that the methodology outlined in WCAP-18461 for crediting PPS self-diagnostic functions can be used to provide reasonable assurance that PPS-related LCOs are met, without reliance on performance of Channel Check, COT, ALT, and ALOT manual SRs for certain PPS components. This determination is based on the NRC staff finding that PPS self-diagnostic functions: (1) are more effective and timelier than performance of manual SRs at detecting PPS equipment faults, (2) can be adequately monitored with administrative checks, and (3) satisfy all QA regulatory requirements for their development, testing, installation, maintenance, and operation. The NRC staff determined that reliance on the PPS self-diagnostic functions support meeting the applicable PPS-related LCOs is acceptable under 10 CFR 50.36(c)(2). Therefore, the NRC staff finds that removing surveillance requirements from a plant TS in relation to PPS equipment, for which credited self-diagnostic coverage is provided, is acceptable with implementation of the application specific action items.

The NRC staff also finds the methodology for allocating response times for PPS equipment acceptable because the overall effect of any degradation in the PPS components either would not have adverse impact on the response time or would be compensated with a conservative allotted response time. Therefore, the NRC staff concludes the TR supports compliance with requirements of 10 CFR 50.55a(h) and 10 CFR 50.36(c).

7.0 REFERENCES

1. Submittal of Westinghouse, WCAP-18461-P/NP, "Common Qualified Platform Surveillance Elimination Topical Report" (ADAMS Accession No. ML20070R083).

2. Safety Evaluation for Westinghouse Topical Report “WCAP-16097-P/NP-A, Revision 4, ‘Common Qualified Platform’” (ADAMS Package Accession No. ML20020A003).

3. Safety Evaluation for Westinghouse Topical Report “WCAP-16096-P/NP, Revision 5, ‘Software Program Manual for Common Q™ Systems’” (ADAMS Accession No. ML18337A335).

4. Electric Power Research Institute TR-106439, “Guideline on Evaluation and Acceptance of Commercial Grade Digital Equipment for Nuclear Safety Applications,” dated

October 1996.

5. NRC Review of EPRI Topical Report TR-106439, "Guideline on Evaluation and Acceptance of Commercial Grade Digital Equipment for Nuclear Safety Applications," dated July 17, 1997 (ADAMS Accession No. ML12205A284).

6. EPRI TR-107330, "Generic Requirements Specification for Qualifying a Commercially Available PLC for Safety-Related Application in Nuclear Power Plants," dated December 1996.

7. NRC Review of EPRI TR-107330 (ADAMS Legacy Accession No. 9808120281).

8. Submittal of Draft Supplemental Information Related to WCAP-18461-P and WCAP-18461-NP, dated March 25, 2020 (ADAMS Package Accession No. ML20090A239).

9. Vogtle Electric Generating Plant Units 3 and 4 Issuance of Amendment (LAR 19-001), dated November 22, 2019 (ADAMS Accession No. ML19297C791).

Principal Contributor:

Date:

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Comment Number	Comment Location Page/Line Number	Comment Type	Comment	NRC Response
1	Page 2/ Line 32-33	Editorial	"Common Qualification (Common Q)" should be changed to: "the Common Qualified (Common Q) platform"	
2	Page 2/Line 35	Clarification	Does the term "channel operability tests" encompass response time testing?	
3	Page 3/Line 9	Editorial	"process protection system (PPS)" should be changed to: "plant protection system (PPS)"	
4	Page 4/Line 8	Clarification	AC160 Self-Diagnostics encompasses the bullets listed below this line. Therefore, recommend deleting the first bullet.	
5	Page 5/Line 8	Editorial	"Watchdog Timer (WDT)" should be changed to "WWDT"	
6	Page 5/Line 11	Editorial	"WDT" should be changed to "WWDT"	
7	Page 5/ Lines 12-13	Editorial	Suggest changing: "Appendix A of the Common Q, TR WCAP-16097, Revision 5 (ADAMS Package Accession No. ML20171A339) provides additional information on the watchdog timer configuration." To: "The Common Q TR, WCAP-16097, Revision 5 (ADAMS Package Accession No. ML20171A339) provides additional information on the watchdog timer configuration." There is no Appendix A of the Common Q TR. However, this information is in WCAP-16097, Revision 5.	

Comment Number	Comment Location Page/Line Number	Comment Type	Comment	NRC Response
8	Page 5/Lines 16-17	Proprietary	The following should be marked as proprietary: [ ]a,c	
9	Page 5/Lines 24 – 29	Proprietary	The following should be marked as proprietary: [ ]a,c	
10	Page 5/Lines 45 – 49 Page 6/Lines 1 – 4	Proprietary	The following should be marked as proprietary: [ ]a,c	

Comment Number	Comment Location Page/Line Number	Comment Type	Comment	NRC Response
11	Page 5/Lines 45-46	Clarification	Why is the following statement made: [ ]a,c [ ]a,c	
12	Page 7/Lines 1 – 3	Proprietary	The following should be marked as proprietary: [ ]a,c	

Comment Number	Comment Location Page/Line Number	Comment Type	Comment	NRC Response
13	Page 7/Lines 6 – 19	Proprietary	The following should be marked as proprietary: [ ][a,c]	

Comment Number	Comment Location Page/Line Number	Comment Type	Comment	NRC Response
14	Page 7/Line 9	Clarification	[ ]a,c	
15	Page 7/Lines 42 – 43	Proprietary	The following should be marked as proprietary: [ ]a,c	
16	Page 8/Lines 6 – 8	Proprietary	The following should be marked as proprietary: [ ]a,c	
17	Page 8/Lines 14 – 17	Proprietary	The following should be marked as proprietary: [ ]a,c	

Comment Number	Comment Location Page/Line Number	Comment Type	Comment	NRC Response
18	Page 9/Line 50 Page 10/Line 2 Page 13/Line 22 Page 13/Line 36 Page 14/Line 10 Page 16/Line 21 Page 16/Line 30 Page 16/Line 32 Page 16/Line 36 Page 16/Line 43 Page 17/Line 38 Page 17/Line 39 Page 17/Line 44 Page 17/Line 45 Page 17/Line 49 Page 19/Line 11 Page 19/Line 21 Page 19/Line 30 Page 19/Line 31 Page 19/Line 50 Page 20/Line 25 Page 20/Line 27 Page 21/Line 4	Editorial	“Common-Q” should be changed to “Common Q”	

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Comment Number	Comment Location Page/Line Number	Comment Type	Comment	NRC Response
19	Page 11/Lines 2 – 8	Proprietary	The following should be marked as proprietary: [ ]a,c	
20	Page 11/Lines 10 – 11	Proprietary	The following should be marked as proprietary: [ ]a,c	
21	Page 11/Lines 13 – 14	Proprietary	The following should be marked as proprietary: [ ]a,c	
22	Page 11/Lines 15 – 17	Proprietary	The following should be marked as proprietary: [ ]a,c	

Comment Number	Comment Location Page/Line Number	Comment Type	Comment	NRC Response
23	Page 11/Line 21 Page 13/Line 2 Page 13/Line 28 Page 14/Line 7 Page 17/Line 32 Page 20/Line 25	Editorial	"PMS" should be changed to "PPS"	
24	Page 11/Lines 33 – 37	Proprietary	The following should be marked as proprietary: [ ]a,c	
25	Page 13/Line 21	Editorial	"…operability PPS components…" should be changed to: "…operability of PPS components…"	
26	Page 15/Line 1	Editorial	"TRs" should be changed to "SRs"	
27	Page 16/Lines 32-34	Proprietary	The following should be marked as proprietary: [ ]a,c	

Comment Number	Comment Location Page/Line Number	Comment Type	Comment	NRC Response
28	Page 16/Lines 36 – 41	Proprietary	The following should be marked as proprietary: [ ]a,c	
29	Page 20/Lines 25 – 29	Proprietary	The following should be marked as proprietary: [ ]a,c	
30	Page 21/Line 18	Clarification	Licensees need more guidance in this SER to determine if the criteria are met for an acceptable risk profile.	